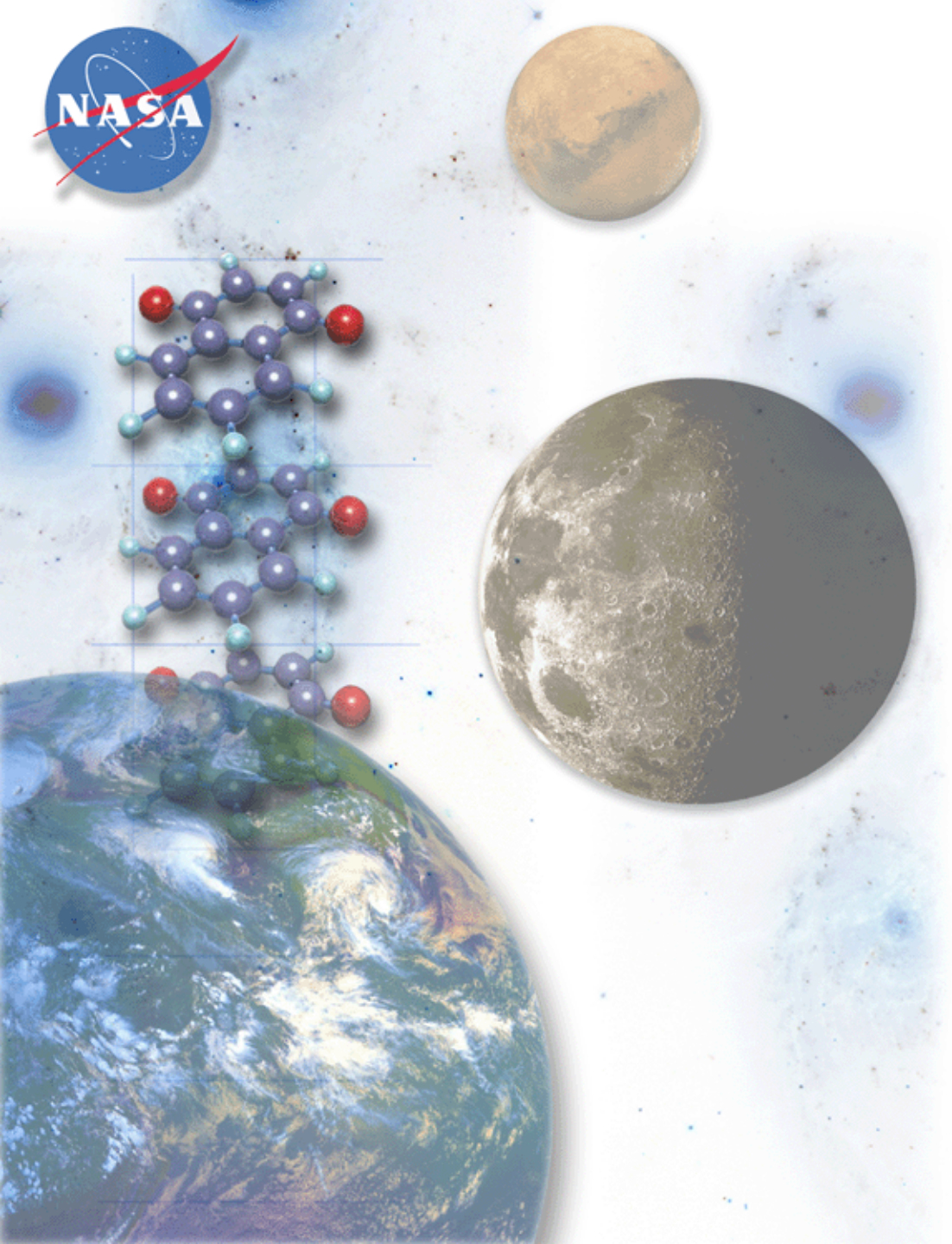


NASA Exploration Team

FY01 Annual Report

National Aeronautics and
Space Administration

November 2001

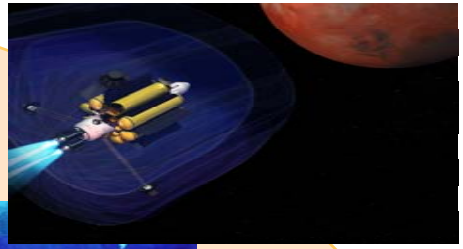
Introduction

- The NASA Decadal Planning Team (DPT) evolved into the Exploration Team (NEXT)
  - Chartered in June 1999 to create a powerful new integrated vision and strategy for space exploration
  - Developed technology roadmaps to enable the science-driven exploration vision
  - Established cross-Enterprise, cross-Center systems engineering team (created a virtual Center)
  - Focused on revolutionary not evolutionary approaches
- NEXT Charter
  - Create an environment for discovery by integrating Agency plans and investment in the future
    - Collapse bureaucratic stovepipes
    - Use a systems approach

Report Available - Setting A Course for Space Exploration in the 21st Century

Stepping Stones

Go anywhere, anytime



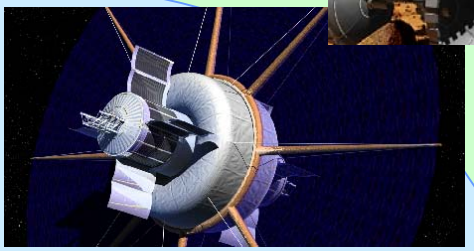
Sustainable Planetary Presence

- Traveling out to ~1.5 AU, and beyond
- Enabling sustainable scientific research
- Sustaining operations on another planet
- Staying for indefinite periods

Accessible Planetary Surface

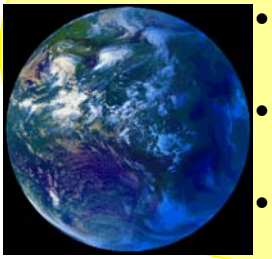
- Traveling out to 1.5 AU
- Enabling tactical investigations
- Visiting and operating on another planet
- Staying for 1-3 years

Earth's Neighborhood



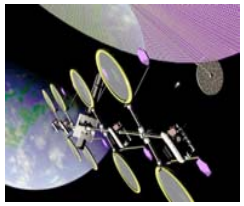
- Traveling up to 1.5 million km
- Enabling huge optical systems
- Operating in deep space
- Staying for 50-

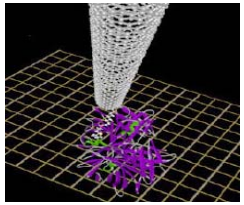
Earth and LEO



- Space Station experience
- Solar System learning
- Technology advancements

Enabling the Stepping Stones





The Hurdles

- **In-Space Transportation**
  - Safe, efficient, and economical
  - Multi-use, robotic and human capabilities
- **Crew Health and Safety**
  - Countermeasures to environmental effects
  - Medical autonomy
- **Human/Robotic Partnership**
  - Dramatically higher productivity, on-site intelligence
- **Affordable, Abundant Power**
  - Solar
  - Nuclear
- **Space Systems Performance**
  - Low-mass, self-healing, self-assembly
  - Automated reasoning, smart sensing, reliable

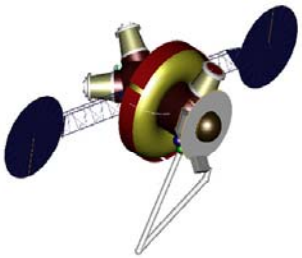
What must we know to make informed decisions?

The Criteria

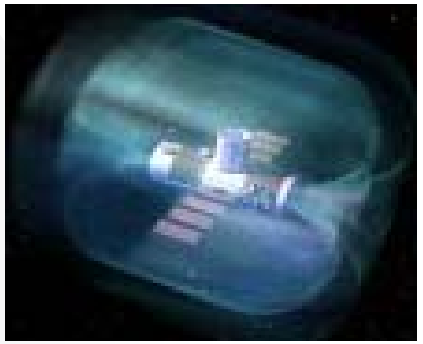
- **Acceptable knowledge about destinations**
- **Goals/objectives defined for optimal mix of robots and humans**
- **Certification of systems and/or crews for deep space operations**
- **Acceptable technology readiness achieved**
- **Reliable and plausible mission concepts**
- **High return anticipated**
  - Science impact
  - Education Benefits
  - Technology/ Infrastructure
- **Partnership opportunities identified**

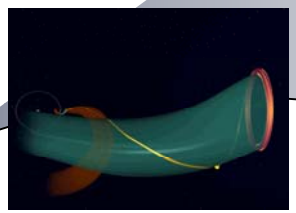
NEXT Approach

New Concepts and Current Technologies



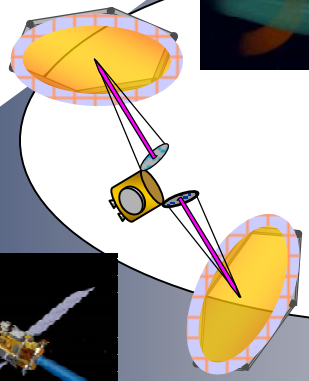
Create Innovative Concepts — and drive out Opportunities/ Needs for Revolutionary Advances in Technology





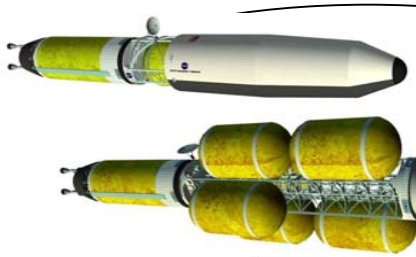
Revolutionary Concepts Using Breakthrough Technologies

New Concepts



New Concepts Using New Technologies

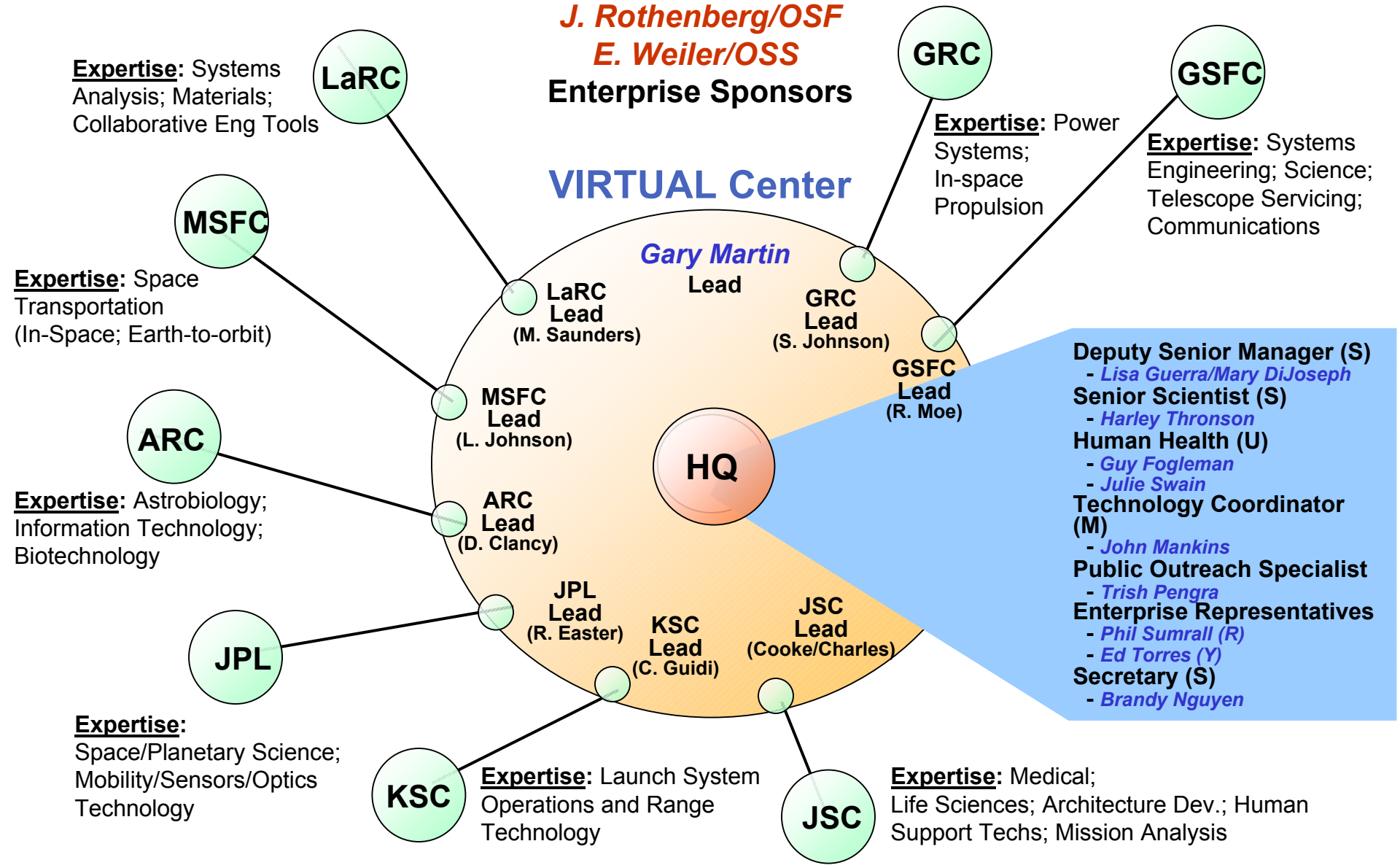
Current Concepts & Technologies



Current Concepts and New Technologies

New Technologies

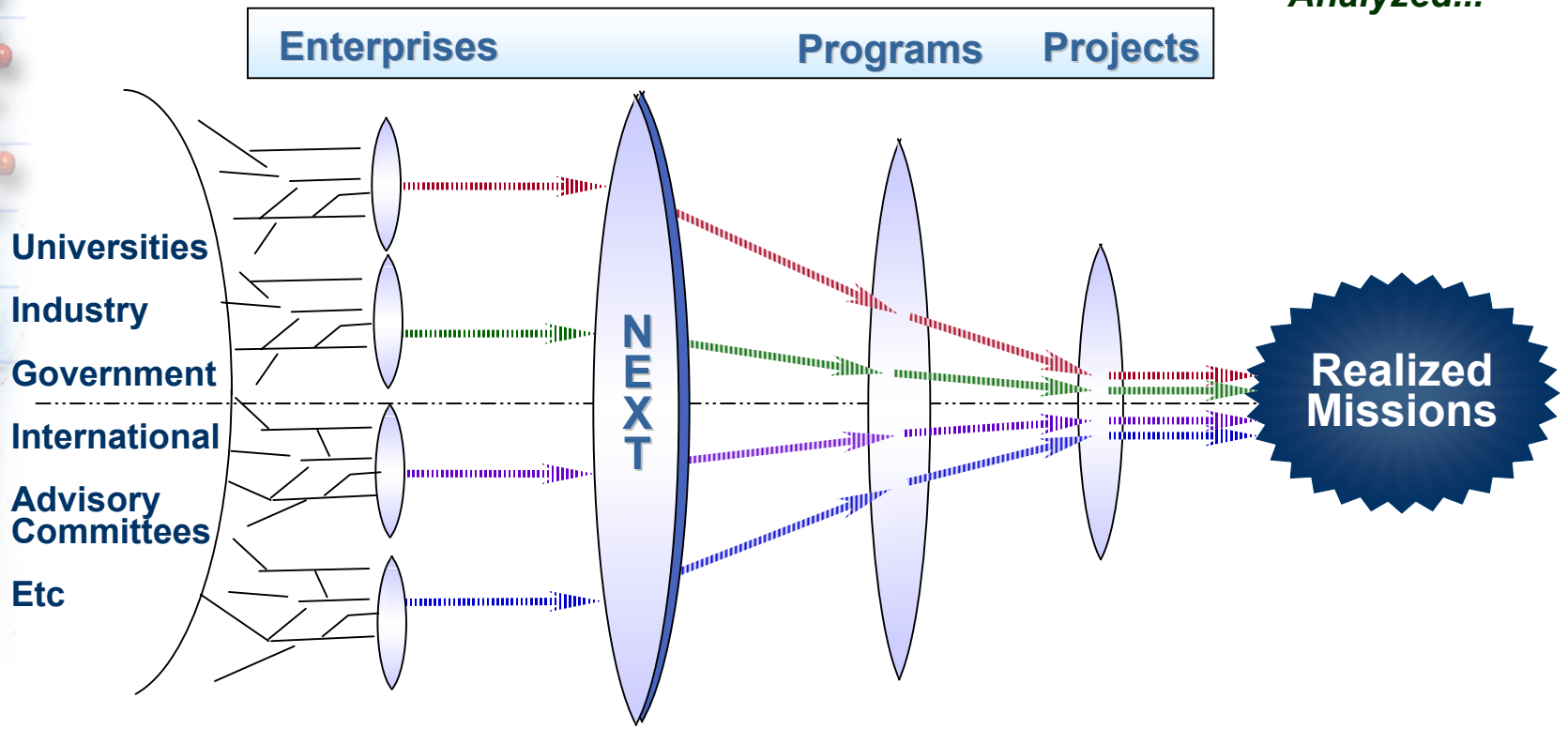
NEXT in FY01


J. Rothenberg/OSF
E. Weiler/OSS
Enterprise Sponsors
VIRTUAL Center
Gary Martin
Lead
HQ
LaRC
Lead
(M. Saunders)
GRC
Lead
(S. Johnson)
GSFC
Lead
(R. Moe)
MSFC
Lead
(L. Johnson)
ARC
Lead
(D. Clancy)
JPL
Lead
(R. Easter)
KSC
Lead
(C. Guidi)
JSC
Lead
(Cooke/Charles)
Deputy Senior Manager (S)
- Lisa Guerra/Mary DiJoseph
Senior Scientist (S)
- Harley Thronson
Human Health (U)
- Guy Fogleman
- Julie Swain
Technology Coordinator (M)
- John Mankins
Public Outreach Specialist
- Trish Pengra
Enterprise Representatives
- Phil Sumrall (R)
- Ed Torres (Y)
Secretary (S)
- Brandy Nguyen
LaRC
Expertise: Systems Analysis; Materials; Collaborative Eng Tools
GRC
Expertise: Power Systems; In-space Propulsion
GSFC
Expertise: Systems Engineering; Science; Telescope Servicing; Communications
MSFC
Expertise: Space Transportation (In-Space; Earth-to-orbit)
ARC
Expertise: Astrobiology; Information Technology; Biotechnology
JPL
Expertise: Space/Planetary Science; Mobility/Sensors/Optics Technology
KSC
Expertise: Launch System Operations and Range Technology
JSC
Expertise: Medical; Life Sciences; Architecture Dev.; Human Support Techs; Mission Analysis

Why NASA Needs NEXT?

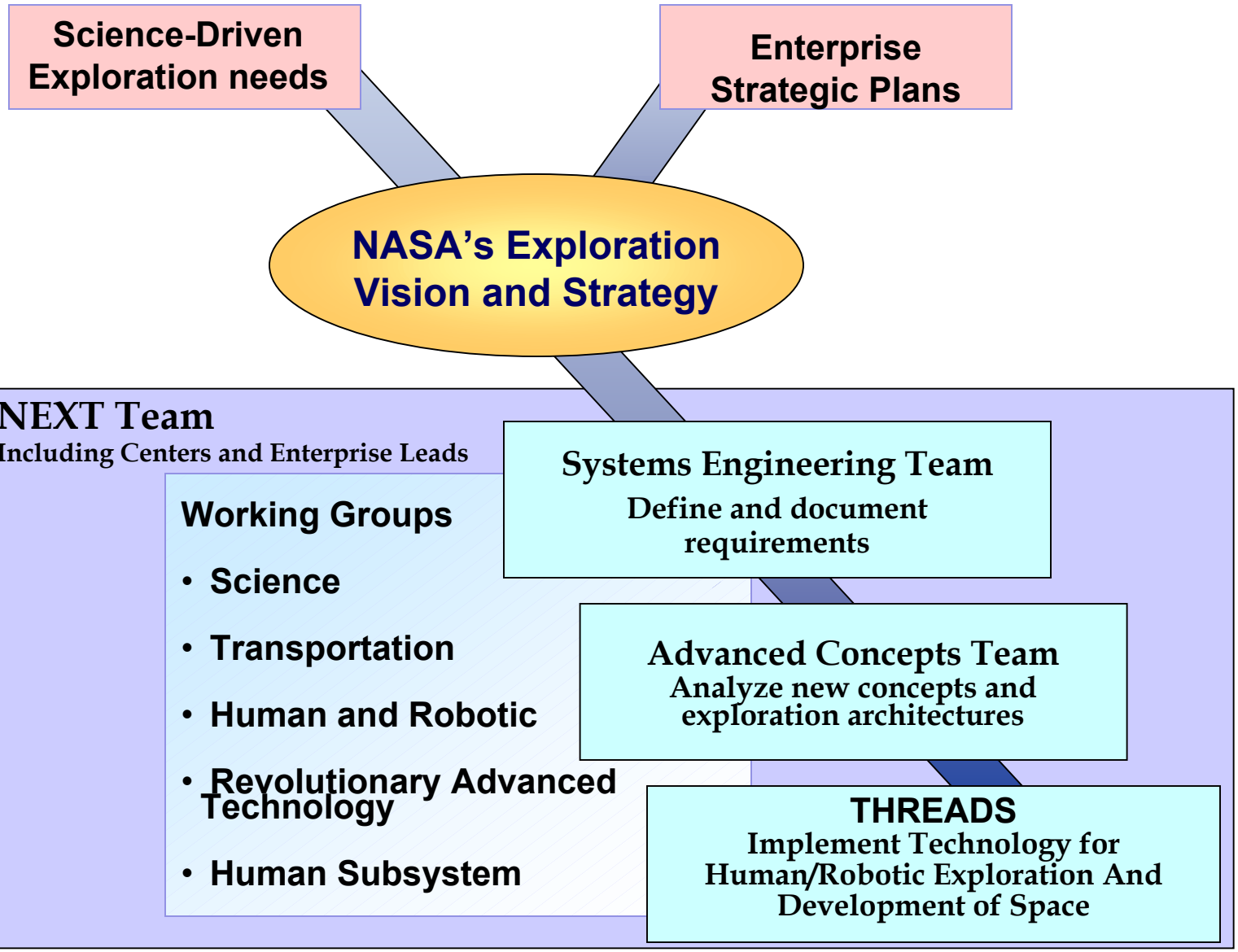
Initial Focusing → **Final Focusing** →

Combining the Best Synergistic Features of ~All Architectures Identified and Analyzed...



NEXT acts as a think tank for integrating new concepts and technology across NASA Enterprises

NEXT Systems Engineering Approach



Reports Available - NEXT Systems Engineering Plan and Requirements

Integrated Exploration

Strategic Focus	Progress in FY01
Driven by Science and Discovery	• Began to identify the best ways to use humans and robots through workshops and analysis • Performed analysis of integrated robot/human interactions for post 2010

Safety and Cost Conscious	• Continued research of breakthrough technology and concepts, e.g.
	  • Hybrid propellant Module
	  • Mini Magnetospheric Plasma Propulsion
	  • Interplanetary Highways

Progressive Approach	• Prioritized in-space propulsion technology across Enterprise needs • Focused on the first step: Earth's Neighborhood
Leveraging Partnerships	• Co-funded retroreflector rendezvous project with NRL • Identified collaboration through DoD Technology Area Review and Assessment (TARA)
Emphasizing Education	• Co-funded Steckler University grants on exploration and colonization • Sponsored graphics design class for students at the LA Art Center College, focusing on futuristic concepts for astronauts exploring space